

# MGate MB3000 Modbus Gateway

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## User's Manual

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[www.moxa.com/product](http://www.moxa.com/product)



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# **MGate MB3000 Modbus Gateway User's Manual**

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# Introduction

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Welcome to the MGate MB3000 line of Modbus gateways. All models feature easy integration of Modbus TCP to Modbus RTU/ASCII and feature RS-232/422/485 ports for Modbus serial communication. One, two, and four-port models are available.

This chapter is an introduction to the MGate MB3000 and includes the following sections:

- ☐ **Overview**
- ☐ **Package Checklist**
- ☐ **Product Features**
- ☐ **Product Specifications**

## Overview

The MGate MB3000 is a line of protocol gateways that provides users with

- seamless integration of Ethernet and serial Modbus devices
- powerful operation modes to handle almost any Modbus application
- Windows utilities for easy setup and traffic monitoring

### Seamless integration of Ethernet and serial Modbus devices

Modbus is one of the most popular automation protocols in the world, supporting traditional RS-232/422/485 devices and recently developed Ethernet devices. Many industrial devices, such as PLCs, DCSs, HMIs, instruments, and meters, use Modbus as their communication standard. However, the Ethernet-based Modbus protocol is so different from the original serial-based protocols that a communication gateway is needed as a bridge for integration.

In order to integrate Modbus networks, the MGate MB3000 includes an Ethernet port and up to four serial ports that support RS-232, RS-422, and RS-485 communication. It automatically and intelligently translates between Modbus TCP (Ethernet) and Modbus ASCII/RTU (serial) protocols, allowing Ethernet-based PLCs to control instruments over RS-485 without additional programming or effort.

### Powerful operation modes to handle almost any Modbus application

With the Modbus protocol, devices must be clearly defined as either masters or slaves. Unlike other Modbus gateways, the MGate MB3000's operation modes allow users to select master or slave operation for each serial port. Not only does the MB3000 allow Ethernet masters to control serial slaves, it also allows serial masters to control Ethernet slaves. On multiport models, each serial port's operation mode is independent of the other ports, so that one port may be configured for slave mode and another port configured for master mode.

Extra address mapping and exception parameters are provided to ensure that most situations can be handled.

### Windows utilities for easy setup and traffic monitoring

A Windows utility is provided to make configuration and operation of the MGate MB3000 as easy as possible. The utility automatically connects to all available MGate MB3000 units on the LAN for you. Traffic monitoring functions help you troubleshoot Modbus communication problems by tracking items such as connection status and address translation errors.

## Package Checklist

All models in the MGate MB3000 line are shipped with the following items:

#### *Standard Accessories*

- 1 MGate MB3180 or MGate MB3480 Modbus gateway
- Document & software CD
- Quick Installation Guide
- Power adaptor
- Product warranty statement

#### *Optional Accessories*

- DK-35A DIN-rail mounting kit (35 mm)

NOTE: Notify your sales representative if any of the above items is missing or damaged.

## Product Features

All models in the MGate MB3000 line enjoy the following features:

- Integration of Modbus TCP and Modbus RTU/ASCII networks
- Up to 31 Modbus RTU/ASCII slaves per serial port
- Up to 32 Modbus TCP connections with Modbus RTU/ASCII masters
- Configuration over Ethernet with easy-to-use Windows utility
- 10/100M Fast Ethernet with automatic IP setting (DHCP)
- Software-selectable RS-232/485/422 communication
- High speed serial interface supporting 921.6 Kbps

## Product Specifications

### LAN

Ethernet	10/100 Mbps, RJ45, Auto MDI/MDIX
Protection	Built-in 1.5 KV magnetic isolation

### Serial Interface

Interface	RS-232/422/485	
No. of Ports	MB3180: 1 port MB3480: 4 ports	
Port Type	DB9 Male	
Signals	RS-232:	TxD, RxD, RTS, CTS, DTR, DSR, DCD, GND
	RS-422:	Tx+, Tx-, Rx+, Rx-, GND
	RS-485 (2-wire):	Data+, Data-, GND
	RS-485 (4-wire):	Tx+, Tx-, Rx+, Rx-, GND
Serial Line Protection	15 KV ESD for all signals	
RS-485 Data Direction	Patented ADDC™	

### Serial Communication Parameters

Parity	None, Even, Odd, Space, Mark
Data Bits	7, 8
Stop Bits	1, 2
Flow Control	RTS/CTS, XON/XOFF
Transmission Speed	50 bps to 921.6 Kbps

### Software Features

Operation mode	RTU Slave, RTU Master, ASCII Slave, ASCII Master
Utilities	MGate Manager
Multi-masters and multi-request	16 simultaneous TCP masters, 32 simultaneous requests for each TCP master
Configuration	Windows utility

**Power Requirements**

Power Input	12 to 48 VDC
Power Socket	MB3180: Power jack MB3480: Power jack and terminal block
Power Consumption	

**Mechanical**

Material	MB3180: Aluminum (1 mm) MB3480: SECC sheet metal (0.8 mm)
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**Environment**

Operating Temperature	0 to 55°C (32 to 131°F), 5 to 95%RH
Storage Temperature	-20 to 85°C (-4 to 185°F), 5 to 95%RH

**Regulatory Approvals**

EMC	CE: EN550022 Class A/EN550024 FCC: FCC Part 15 subpart B, Class A
Safety	TÜV: EN60950-1
Shock	IEC60068-2-27
Freefall	IEC60068-2-23
Vibration	IEC60068-2-6
EMS	EN61000-4-2 (ESD), Level 2 EN61000-4-2 (ESD), Level 2 EN61000-4-4 (EFT), Level 2 EN61000-4-5 (Surge), Level 2 EN61000-4-6 (CS), Level 2 EN61000-4-8 EN61000-4-11 EN61000-4-12
Warranty	5 years



# 2

## Getting Started

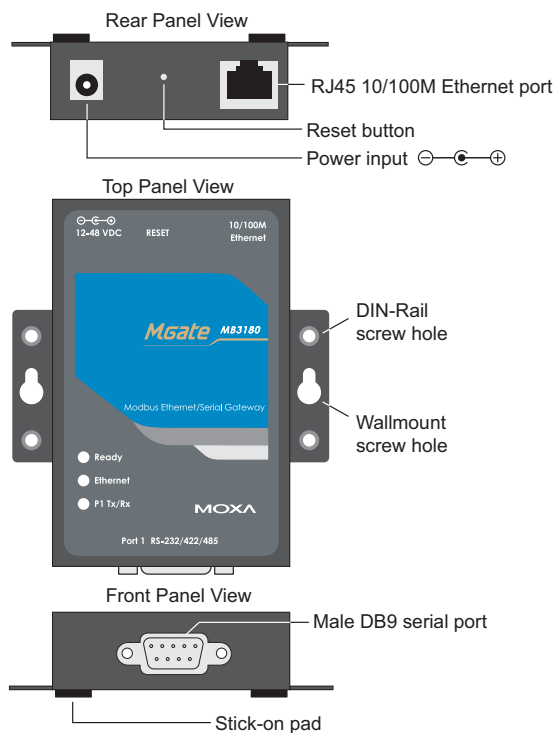
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This chapter includes information about installing the MGate MB3000. The following topics are covered:

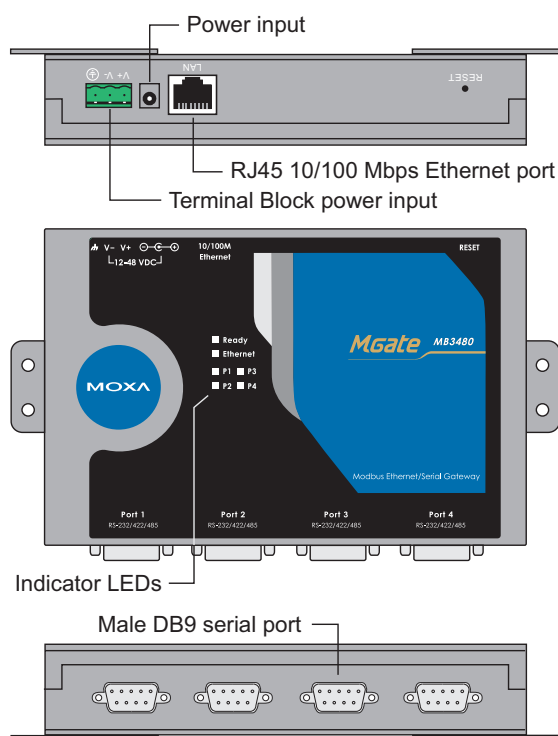
- ❑ **Panel Layout**
- ❑ **Dimensions**
- ❑ **Connecting Power**
- ❑ **Connecting Serial Devices**
- ❑ **Connecting to a Host or the Network**
- ❑ **RS-485 Termination and Pull High/Low Resistors**
- ❑ **Installing the Software**
- ❑ **Mounting the Unit**
  - DIN-Rail
  - Wall Mount

## Panel Layout

### MGate MB3180

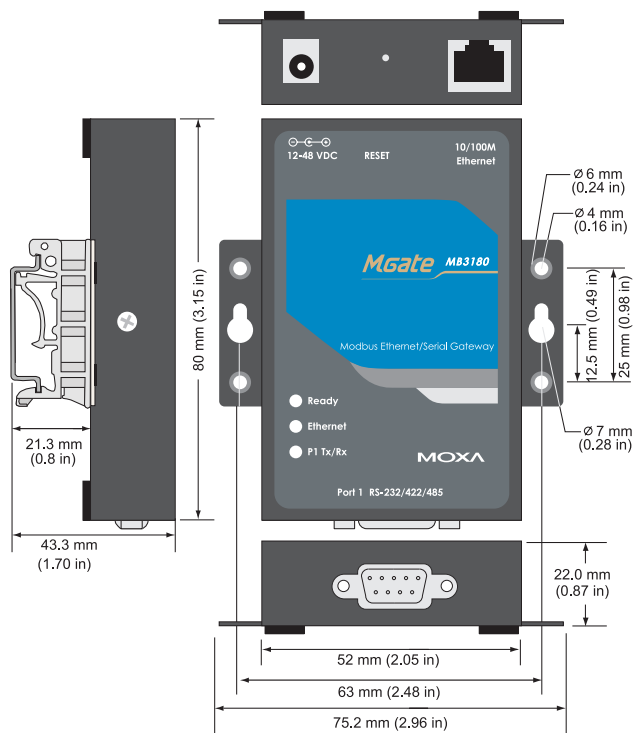


### MGate MB3480

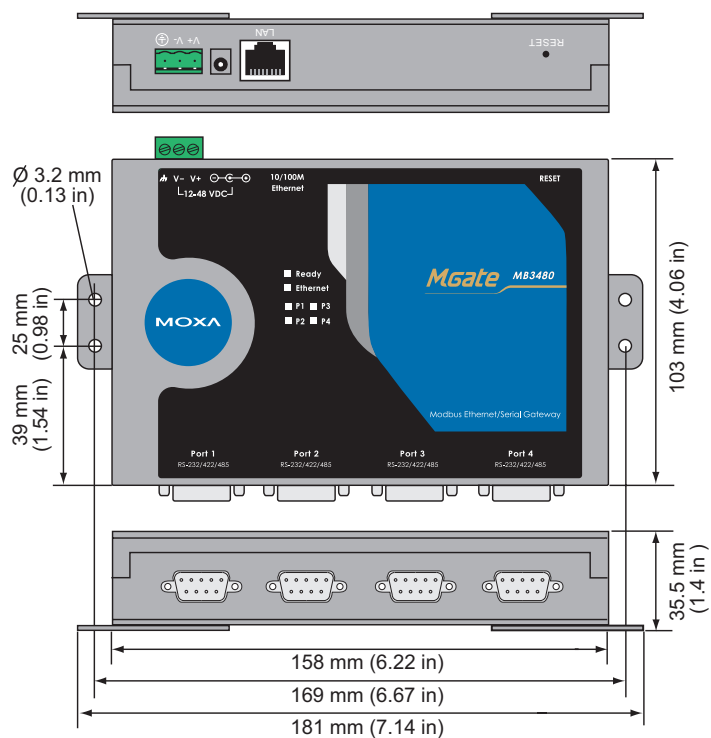


## Dimensions

### MGate MB3180



### MGate MB3480



## Connecting Power

The unit can be powered using the AC adaptor or by connecting a power source to the terminal block.

Follow these instructions to supply power using the AC adaptor:

1. Plug the connector of the power adapter into the DC-IN jack on the back of the unit.
2. Plug the power adapter into an electrical outlet.

Follow these instructions to connect a power source to the terminal block:

1. Loosen or remove the screws on the terminal block.
2. Connect the 12-48 VDC power line to the terminal block.
3. Tighten the connections using the screws on the terminal block.

Note that the unit does not have an on/off switch. It automatically turns on when it receives power. The PWR LED on the top panel will glow to indicate that the unit is receiving power.

## Connecting Serial Devices

The unit's serial port(s) are located on the back panel. There are two options for connecting serial devices, depending on the serial interface:

1. You may use a DB9-to-DB9 cable to connect a serial device to the unit. Plug one end of the cable into the port on the unit's back panel and plug the other end of the cable into the device's serial port.
2. You may make your own customized serial cable to connect a serial device to the unit. For the pin assignments of the unit's serial port, please refer to Chapter 5. This information can then be used to construct your own serial cable.

If you are connecting a RS-485 multidrop network with multiple devices, please note the following:

1. All devices that are connected to a single serial port must use the same protocol (i.e., either Modbus RTU or Modbus ASCII).
2. Each master device must get its own port on the unit. If you are connecting a network with both master and slave devices, the master must be connected on a separate port from the slaves. Furthermore, the master will only be able to communicate to Modbus TCP slaves, not to the ASCII or RTU slaves that are connected on a different serial port.

## Connecting to a Host or the Network

A 10/100BaseT Ethernet jack is located on the unit's front panel. This jack is used for the unit's connection to a host or Ethernet network, as follows:

1. For normal operation, use a standard straight-through Ethernet cable to connect the unit to your Modbus TCP network.
2. For initial configuration or for troubleshooting purposes, you may connect the unit directly to a PC. In this case, use a crossover Ethernet cable to connect the unit to your PC's Ethernet connector.

The unit's Link LED will light up to indicate a live Ethernet connection.

## RS-485 Termination and Pull High/Low Resistors

In some critical RS-485 environments, you may need to add termination resistors to prevent the reflection of serial signals. When using termination resistors, it is important to set the pull high/low resistors correctly so that the electrical signal is not corrupted. For each serial port, DIP

switches or jumper settings are used to enable a 120  $\Omega$  termination resistor and set the pull high/low resistor values.

**To add a 120  $\Omega$  termination resistor**, set switch 3 on the port's assigned DIP switch to ON; set switch 3 to OFF (the default setting) to disable the termination resistor. This function is only available for the MGate MB3480.

**To set the pull high/low resistors to 150 K $\Omega$** , set switches 1 and 2 on the port's assigned DIP switch to OFF for the MGate MB3480. For the MGate MB3180, leave jumpers **JP3** and **JP4** open (not shorted). This is the default setting.

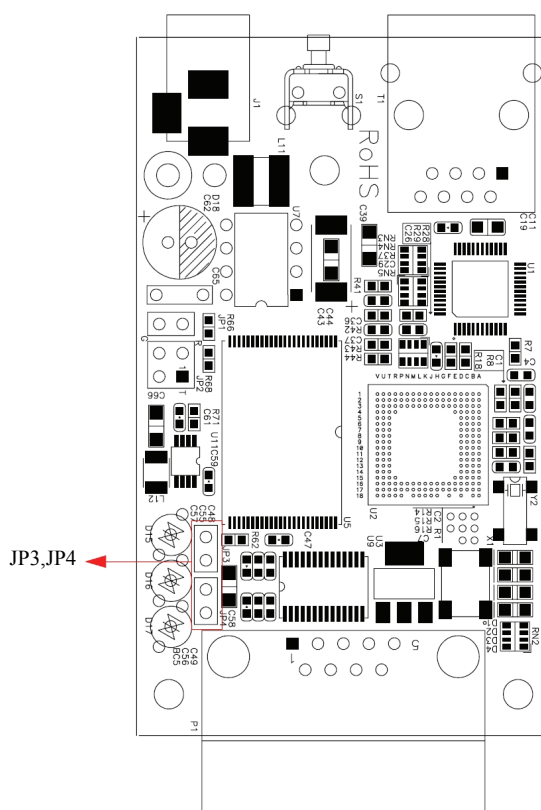
**To set the pull high/low resistors to 1 K $\Omega$** , set switches 1 and 2 on the port's assigned DIP switch to ON for the MGate MB3480. For the MGate MB3180, short jumpers **JP3** and **JP4** with jumper caps.



### ATTENTION

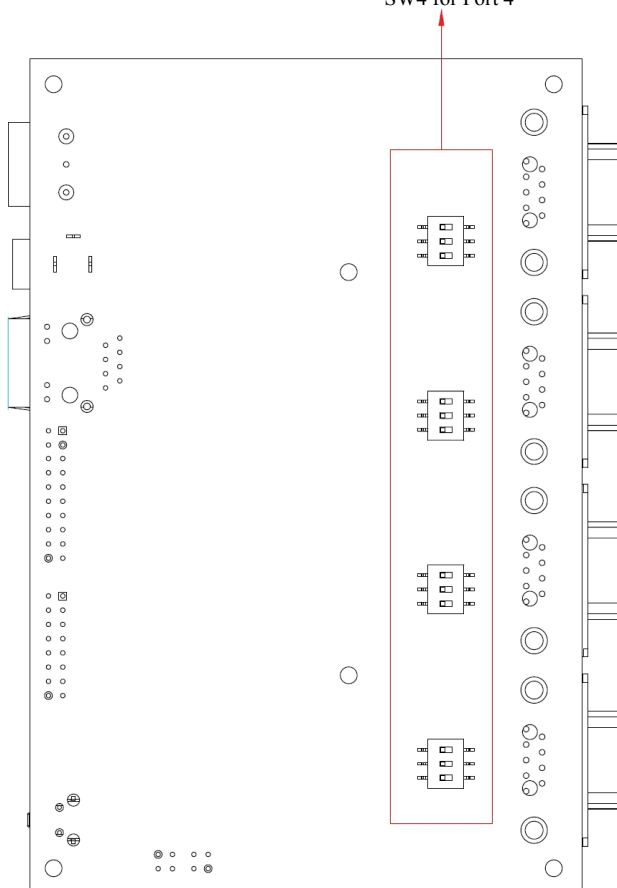
Do not use the 1 K $\Omega$  pull high/low setting on the MGate MB3000 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

### MGate MB3180 jumpers



**MGate MB3480 DIP switches**

SW1 for Port 1  
SW2 for Port 2  
SW3 for Port 3  
SW4 for Port 4



## Installing the Software

The following instructions explain how to install MGate Manager, a utility for configuring and monitoring MGate MB3000 units over the network.

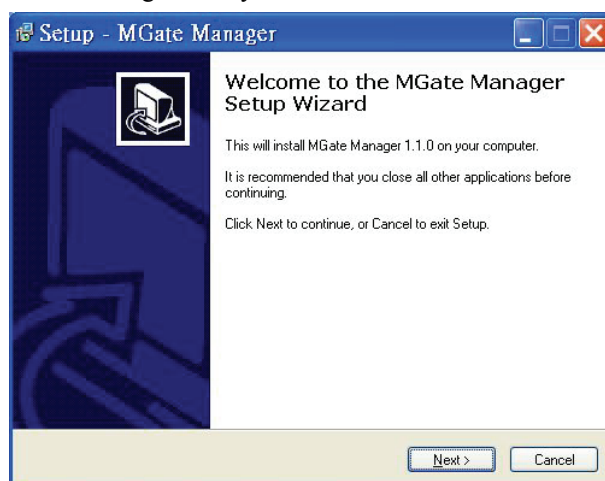
1. Insert the Document and Software CD into the CD-ROM drive. Locate and run the following setup program to begin the installation process:

**MGM\_Setup\_[Version]\_Build\_[DateTime].exe**

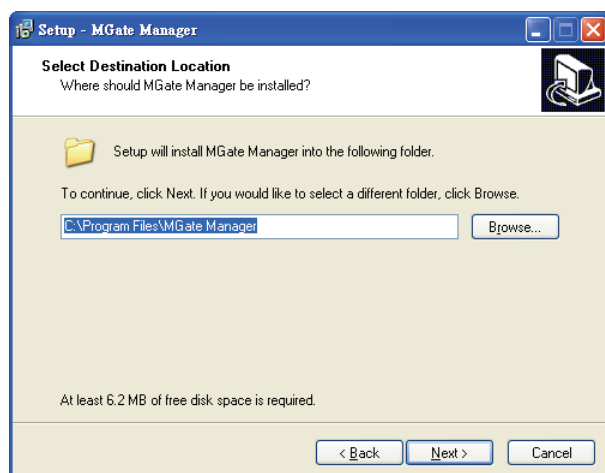
The latest version might be named **MGM\_Setup\_Ver1.1.0\_Build\_07041910.exe**, for example:



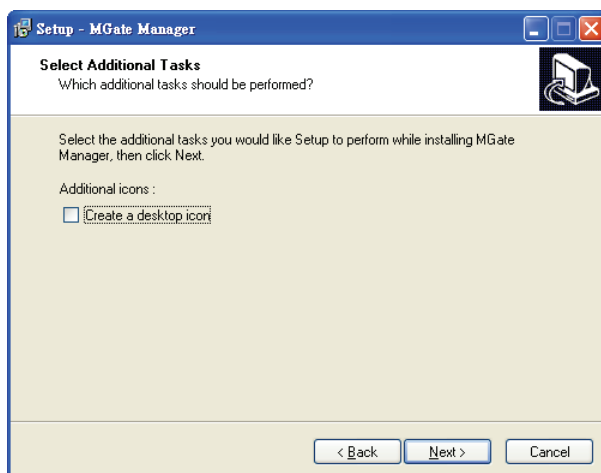
2. You will be greeted by the **Welcome** window. Click **Next** to continue.



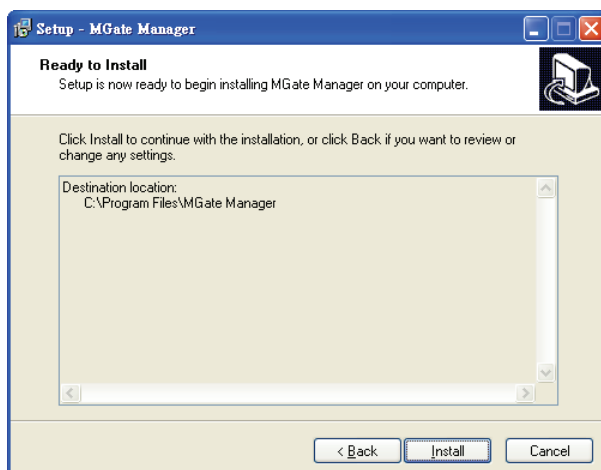
3. When the **Select Destination Location** window appears, click **Next** to continue. You may change the destination directory by first clicking on **Browse...**



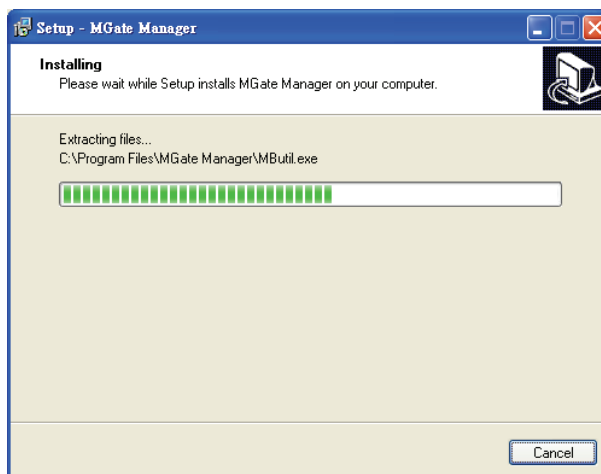
- When the **Select Additional Tasks** window appears, click **Next** to continue. You may select **Create a desktop icon** if you would like a shortcut to MGate Manager on your desktop.



- Click **Next** to start copying the software files.

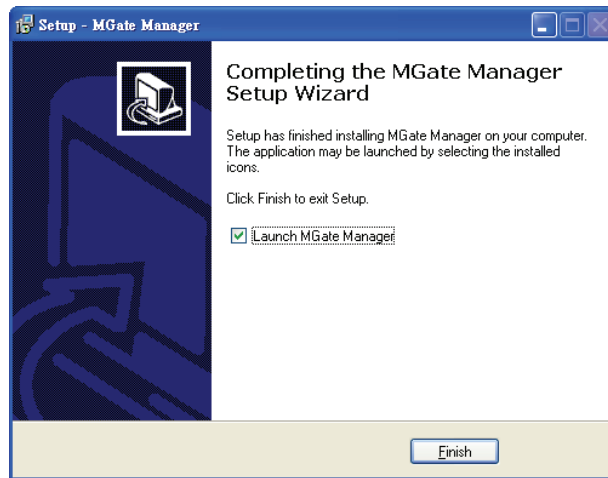


- A progress bar will appear. The procedure should take only a few seconds to complete.

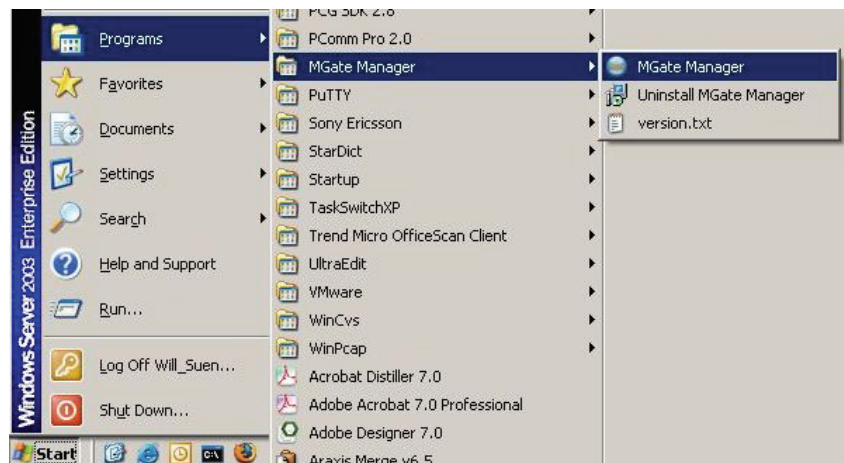




7. A message will indicate that MGate Manager is successfully installed. You may choose to run it immediately by selecting **Launch MGate Manager**.



8. You may also open MGate Manager through **Start → Programs → MGate Manager → MGate Manager**, as shown below.



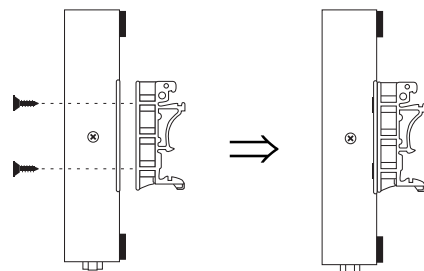
## Mounting the Unit

### DIN-Rail

You can use attachments so the unit can be mounted on a DIN-rail, as shown below.

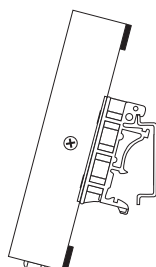
#### STEP 1:

There are two plates on either side of the unit for mounting purposes. On each side, fasten the DIN-rail attachments to the plate using two screws. Make sure that the attachments are oriented as shown in the diagram.

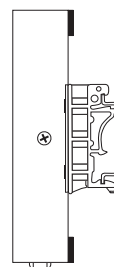


**STEP 2:**

Use the DIN-rail attachments to hook the unit onto the DIN-rail, as shown.

**STEP 3:**

Gently but firmly snap the unit into place. The attachments should fit snugly over the top and bottom edges of the DIN-rail.



**NOTE:** The DIN-rail mounting kit is an optional accessory.

To remove the unit from the DIN-rail, hold the unit with both hands and use your fingers to pull the attachments off the bottom edge of the DIN-rail. Once the attachments have been unhooked from the bottom edge, you should be able to lift the unit off the rail.

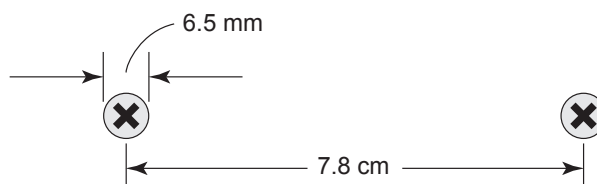
## Wall Mount

The unit can be mounted on the wall using two screws, as shown below.

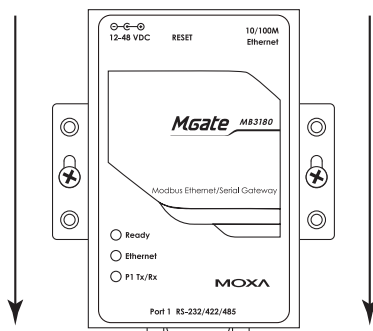
### MGate MB3180

**STEP 1:**

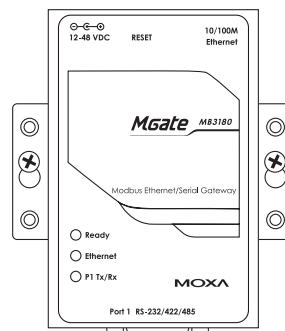
Position the two screws on the wall 7.8 cm apart horizontally, as shown. Make sure the heads are 6.5 mm in diameter or less, with shafts at 3 mm in diameter or less. Tighten the screws but leave about 2 mm of space between the head and the wall.

**STEP 2:**

Hang the unit on the wall by placing the keyhole shaped apertures over the screws, then sliding the unit downwards as indicated shown.

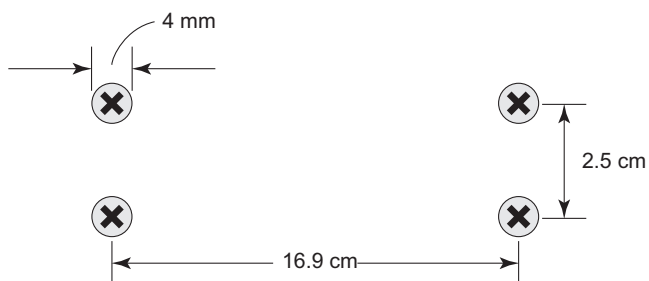
**STEP 3:**

For added stability, tighten the screws.



**MGate MB3480**

**STEP 1:** Attach the fix ribs onto the unit with screws.



**STEP 2:**

Position four screws on the wall, with each screw at the corner of a rectangle 16.9 cm across and 2.5 cm high. Make sure the heads are 6 mm in diameter or less, with shafts at 3 mm in diameter or less. Tighten the screws but leave about 5 mm of space between the head and the wall.

## Typical Applications

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In this chapter, we introduce four typical Modbus applications.

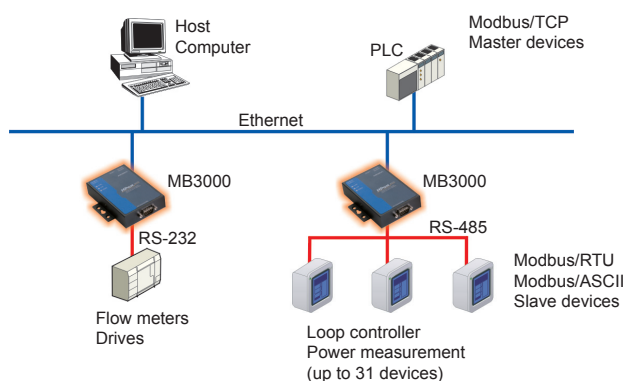
- ☐ **Ethernet Masters with Multiple Serial Slaves**
- ☐ **Serial Masters with Multiple Ethernet Slaves**
- ☐ **Modbus TCP Masters with ASCII and RTU Slaves**
- ☐ **Serial Master with Serial Slaves over Internet**

## Ethernet Masters with Multiple Serial Slaves

### Connect all Modbus devices over an Ethernet network

Most modern PLCs and host computers support Modbus TCP over Ethernet. In order to access discrete Modbus RTU/ASCII devices for data collection and control, they can rely on the MGate MB3000 Modbus gateway.

The MGate MB3000 supports Modbus TCP with up to 16 simultaneous connections. The serial interface supports both RS-232 and RS-422/485, selectable through software. Each serial port can be connected to one RS-232 or RS-422 serial device, or to 31 RS-485 serial devices.

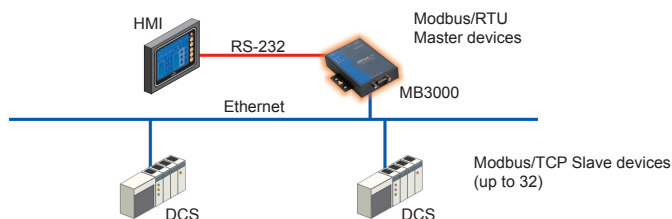


## Serial Masters with Multiple Ethernet Slaves

### Link a serial master device with Ethernet slave devices

Many HMI (Human Machine Interface) systems use a serial interface to connect to a discrete DCS (Data Control System). However, many DCSs are now Ethernet-based and operate as a Modbus TCP slave device.

The MGate MB3000 Modbus gateway can link a serial-based HMI to distributed DCSs over an Ethernet network. Up to 32 Modbus TCP slave devices are supported by each MGate MB3000.

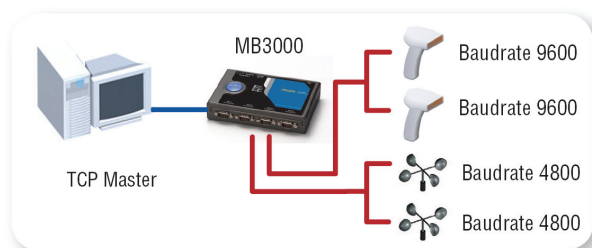


## Modbus TCP Masters with ASCII and RTU Slaves

### Link TCP master devices with both ASCII and RTU serial devices simultaneously

When integrating Modbus networks, you may encounter different Modbus serial networks that use different baudrates or a different protocol. Modbus ASCII might be used by some devices, while Modbus RTU is used by other devices.

The MGate MB3280 and MB3480 can integrate serial Modbus networks that use different parameters or protocols. You can configure each serial port to a specific Modbus serial environment, set up an SID map. After configuration, only the gateway will be visible to Modbus TCP masters, and all serial devices will be integrated behind it.

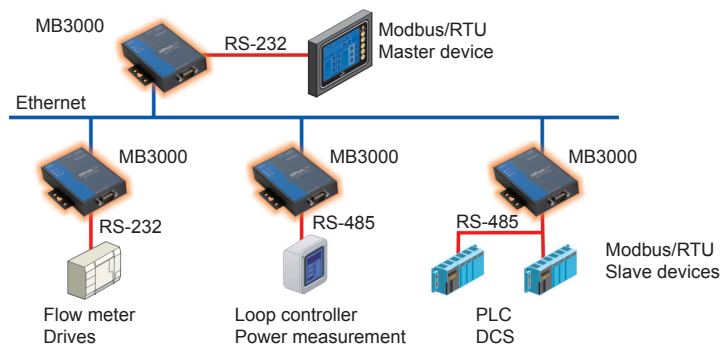


## Serial Master with Serial Slaves over Internet

### Let Modbus serial devices communicate over the Internet

Many Modbus devices communicate over RS-485, which limits the number of devices in a network to 32 and the transmission distance to 1.2 km.

With the MGate MB3000 Modbus gateway, you can link all Modbus devices over an Ethernet network. Up to 32 Modbus gateways can be installed in a single control network, so each device can now be accessed from anywhere the TCP/IP network can reach.



## Configuring the Modbus Gateway

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We discuss the following topics in this chapter:

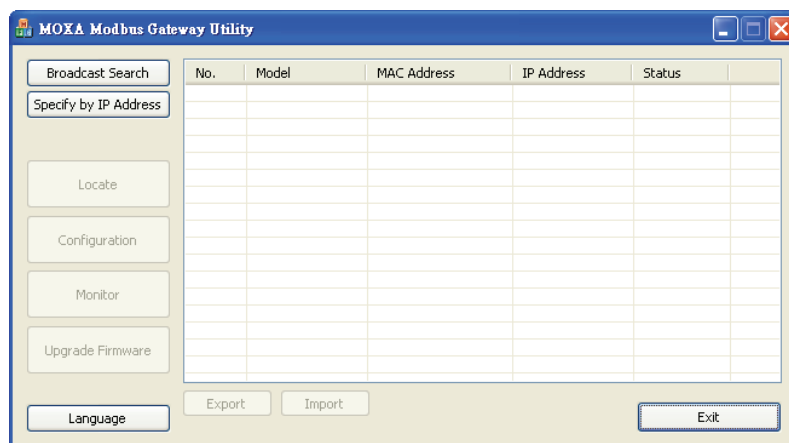
- ❑ **Starting MGate Manager**
  - Change Language Setting
- ❑ **Connecting to the Unit**
  - Broadcast Search
  - Specify by IP Address
- ❑ **Modifying the Configuration**
  - Configure Serial Port for RTU or ASCII, Master or Slave
  - Configure IP Address and Other Network Settings
  - Configure Serial Communication Parameters
  - Set up Slave ID Mapping (Smart Routing)
  - Customize Modbus Settings
- ❑ **Verifying Location of Unit**
- ❑ **Monitoring Modbus Activity**
  - Open Traffic Monitor
  - Filter Traffic Information
  - Save Log to File
- ❑ **Upgrading Firmware**

## Starting MGate Manager

MGate Manager is a Windows-based utility that is used to configure the MGate MB3000. If you have not already installed MGate Manager, please do so by referring to Chapter 2, Getting Started.

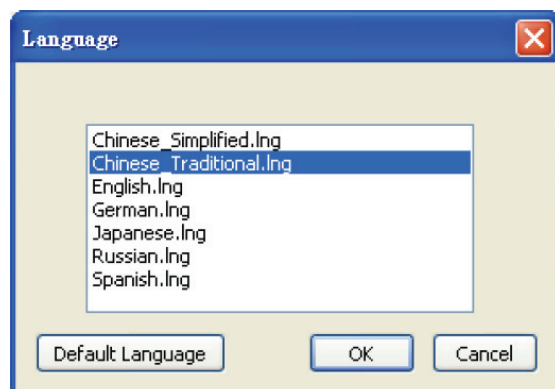
Before running MGate Manager, make sure that your PC and the MGate MB3000 are connected to the same network. Alternatively, the MGate MB3000 may be connected directly to the PC for configuration purposes. Please refer to Chapter 2, Getting Started, for more details.

You may open MGate Manager from the Windows Start menu by clicking **Start → Programs → MGate Manager → MGate Manager**. The MGate Manager window should appear as shown below.



## Change Language Setting

If you wish to run MGate Manager in a different language, you may click **Language** to change the language setting. A dialog box showing the available languages should appear as shown below.



When you click **OK**, MGate Manager will immediately reflect your chosen language.



**ATTENTION**

Use “Default Language” before contacting MOXA Technical Support

With support for multiple languages, MGate Manager is more user-friendly and accessible. However, if you need assistance from MOXA Technical Support, please change the language to “Default Language”. This will prevent any misunderstandings or confusion about MGate Manager menu items and commands as our engineers assist you.

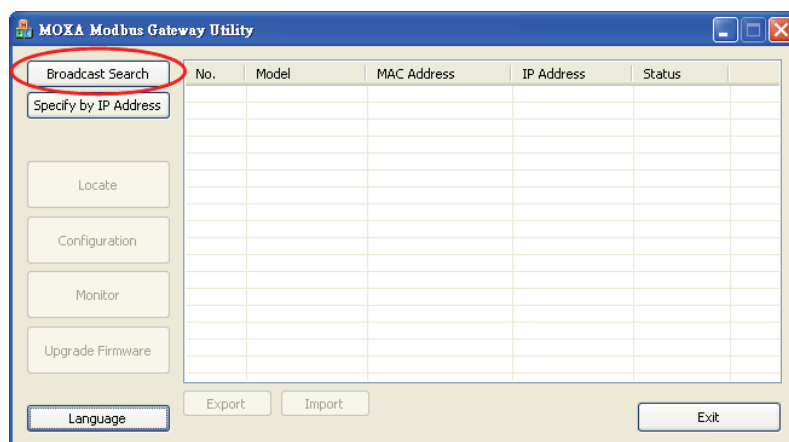
The default language is English and will only be active for the current MGate Manager session. When you open MGate Manager again, the language will revert to your original setting.

## Connecting to the Unit

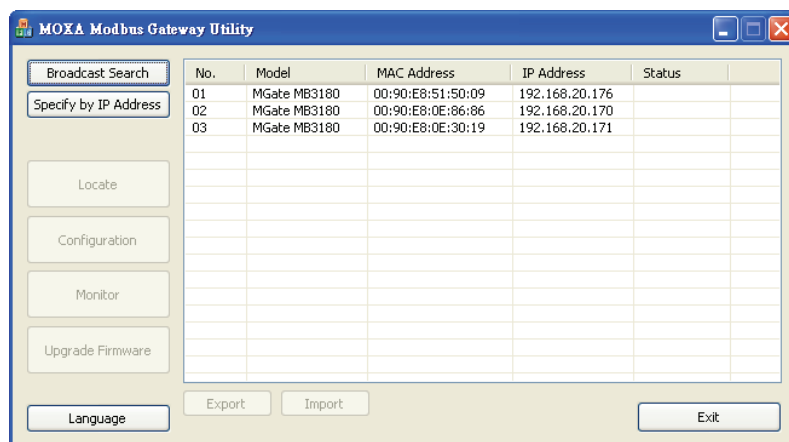
MGate Manager needs to connect to the unit before the unit can be configured. There are two methods to connect to the unit. **Broadcast Search** is used to find every MGate MB3000 on the LAN. **Search by IP** attempts to connect to a specific unit by IP address, which is useful if the unit is located outside the LAN or can only be accessed by going through a router.

### Broadcast Search

Click **Broadcast Search** to begin searching the LAN for all MGate MB3000 units.

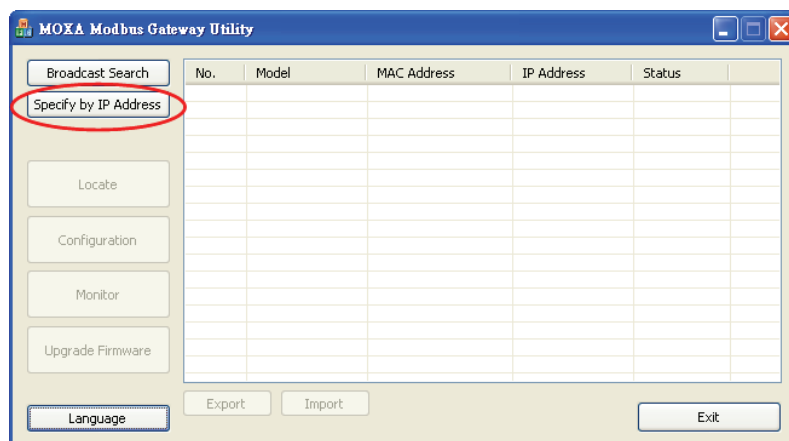


When the search is complete, every MGate MB3000 that is found on the LAN will appear in the window with MAC address and IP address. Simply select the one that you wish to configure.

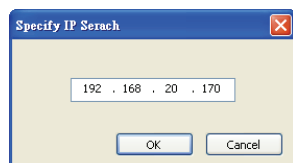


## Specify by IP Address

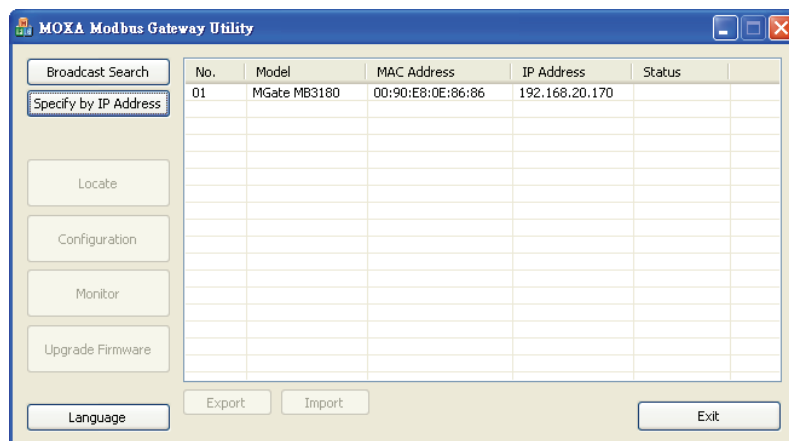
Click **Specify by IP Address** if you know the IP address of the unit and wish to connect to it directly.



A dialog box will appear. Enter the unit's IP address and click **OK**.



If the search is successful, the unit will be listed in MGate Manager. Click the unit to begin configuration.

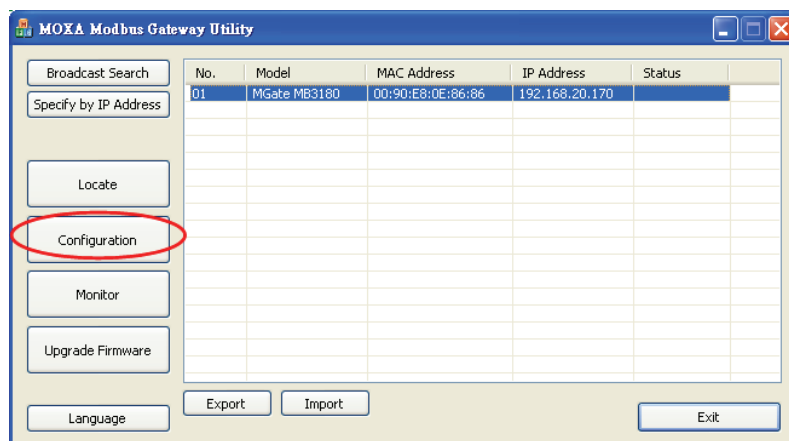
**ATTENTION**

If **Search by IP Address** fails to locate the MGate MB3000, the IP address that you entered might be incorrect. Try doing the search again and re-entering the IP address carefully.

Another possibility is that the MGate MB3000 is located on the same LAN as your PC, but on a different subnet. In this case, you can modify your PC's IP address and/or netmask so that it is on the same subnet as the MGate MB3000. After your PC and the MGate MB3000 are on the same subnet, MGate Manager should be able to find the unit.

## Modifying the Configuration

Once your unit is displayed in MGate Manager, select it by clicking on it. The **Configuration** button will become available. Click **Configuration** to open the configuration window.

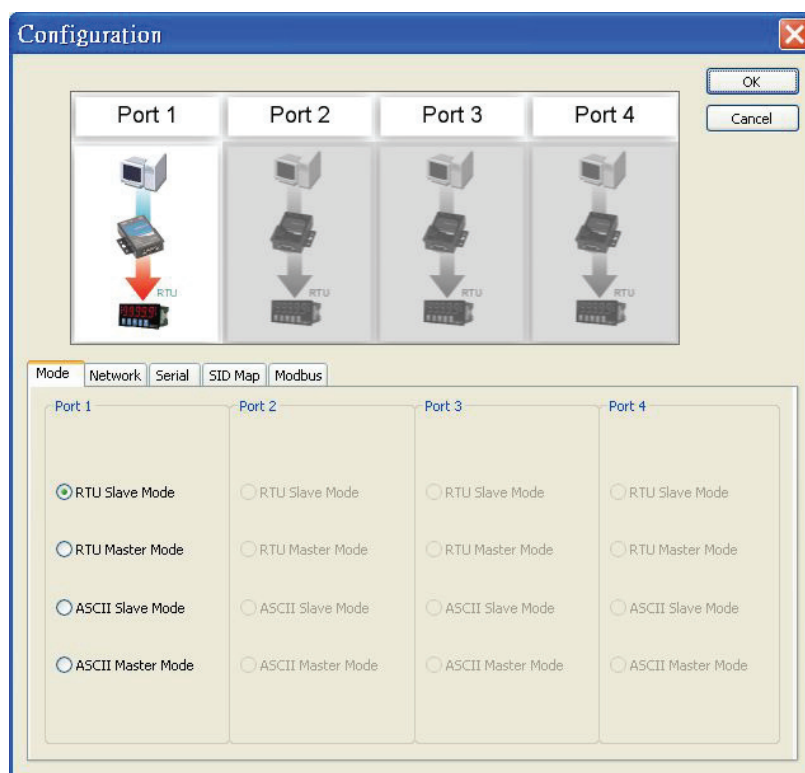


## Configure Serial Port for RTU or ASCII, Master or Slave

The **Mode** tab is where each serial port's operation mode is configured. The operation mode determines whether the device(s) that are connected to the serial port will operate as a master or a slave, and whether the Modbus RTU or Modbus ASCII protocol will be used. There are four operation modes as follows:

Mode	Description
RTU Slave	Modbus RTU slave(s) will be connected to the serial port, to be controlled by Modbus TCP masters.
RTU Master	A Modbus RTU master will be connected to the serial port and will control Modbus TCP slaves.
ASCII Slave	Modbus ASCII slave(s) will be connected to the serial port, to be controlled by Modbus TCP masters.
ASCII Master	A Modbus ASCII master will be connected to the serial port and will control Modbus TCP slaves.

Use the radio buttons to select the desired operation mode for each serial port on the Modbus gateway.



## Configure IP Address and Other Network Settings

The **Network** tab is where the unit's network settings are configured. You can modify the **Name**, **Network Configuration**, **IP Address**, **Netmask**, **Default Gateway**, and **DNS**. You may also select a **Password** to protect the unit from unauthorized access.

**Configuration**

OK Cancel

PIN	SIGNAL
1	RXD+
2	RXD-
3	TXD+
4	X
5	X
6	TXD-
7	X
8	X

Mode Network Serial SID Map Modbus

Name: MG-MB3180\_359 Password:

Network Configure: Static Confirm Password:

IP Address: 192 . 168 . 3 . 122

Netmask: 255 . 255 . 255 . 0

Gateway: 255 . 255 . 255 . 255

DNS1: 0 . 0 . 0 . 0

DNS2: 0 . 0 . 0 . 0

Network Settings		
Parameter	Value	Notes
Name	(an alphanumeric string)	You can enter a name to help you identify the unit, such as the location, function, etc.
Network Configuration	Static IP, DHCP, BootP, or DHCP/BootP	Select "Static IP" if you are using a fixed IP address. Select one of the other options if the IP address is set dynamically.
IP Address	192.168.127.254 (or other 32-bit number)	The IP (Internet Protocol) address identifies the server on the TCP/IP network.
Netmask	255.255.255.0 (or other 32-bit number)	This identifies the server as belonging to a Class A, B, or C network.
Gateway	0.0.0.0 (or other 32-bit number)	This is the IP address of the router that provides network access outside the server's LAN.
DNS1	0.0.0.0 (or other 32-bit number)	This is the IP address of the primary domain name server.
DNS2	0.0.0.0 (or other 32-bit number)	This is the IP address of the secondary domain name server.

Password	(an alphanumeric string)	You can set a password to prevent unauthorized users from configuring the unit. The password will be required when anyone attempts to configure the unit over the network. Modbus operation is not affected by the password.
Confirm password	(an alphanumeric string)	Re-type the password again for confirmation.

**ATTENTION**

To erase an existing password, leave both the **New Password** and **Confirm Password** text input boxes blank. The password will be erased when you click **OK** in the bottom right corner.

## Configure Serial Communication Parameters

The **Serial** tab is where each serial port's communication parameters are configured. You can configure **Baud Rate**, **Parity**, **Data Bits**, **Stop Bit**, **Flow Control**, **FIFO**, and **Interface Mode**.

**Configuration**

DB9 Male

PIN	RS-232	RS-422	RS-485 (A-wire)	RS-485 (B-wire)
1	DCD	TxD(+) / RxD(-)	TxD(+) / RxD(-)	---
2	RxD	TxD(+) / RxD(-)	TxD(+) / RxD(-)	---
3	TxD	RxD(+) / TxD(-)	RxD(+) / TxD(-)	Data(+) / Data(-)
4	DTR	RxD(+) / TxD(-)	RxD(+) / TxD(-)	Data(+) / Data(-)
5	GND	GND	GND	GND
6	DSR	---	---	---
7	RTS	---	---	---
8	CTS	---	---	---

Mode: Network **Serial** SID Map Modbus

**Port 1**

Baudrate: 115200 Flow Control: None

Parity: None FIFO: Enable

Stop bit: 1 Interface: RS232

Data bits: 8

**Port 2**

Baudrate: Flow Control:

Parity: FIFO:

Stop bit: Interface:

Data bits:

**Port 3**

Baudrate: Flow Control:

Parity: FIFO:

Stop bit: Interface:

Data bits:

**Port 4**

Baudrate: Flow Control:

Parity: FIFO:

Stop bit: Interface:

Data bits:

OK Cancel

Serial Settings	
Parameter	Value
Interface Mode	RS-232
	RS-422
	RS-485, 2W
	RS-485, 4W
Baud Rate	50 bps to 961200 bps
Parity	None, Odd, Even, Space, Mark
Data Bits	7, 8
Stop Bits	1, 2
Flow Control	None, Xon/Xoff, RTS/CTS
UART FIFO	Enable, Disable

## Set up Slave ID Mapping (Smart Routing)

The **SID Map** tab is where slave IDs are managed. The definitions on this tab determine how requests will be routed by the unit.

### What Mapping Does

According to the Modbus protocol, all slaves in a network must have a unique ID between 1 and 247, which is used to indicate the intended recipient of a request. Therefore, a slave ID is incorporated into the design of every slave device, regardless of manufacturer, and is usually (but not always) configurable. This is the “actual” slave ID, which is wired or programmed into the device itself.

On the MGate MB3000, a “virtual” slave ID is assigned to each device that will be accessed through the gateway. Any Modbus master that sends a request through the gateway must identify the intended recipient using the virtual slave ID rather than the actual slave ID. The parameters in the SID Map tab will be used by the MGate to route the request to the correct device.

The ID table is what makes smart routing possible for units with multiple serial ports. With proper configuration of the ID table, TCP master commands are sent directly to the serial port holding the device, rather than broadcast to all serial ports. Smart routing keeps communication efficient and prevents devices on one port from slowing down the whole system.



### ATTENTION

Any slave device that is not assigned a virtual slave ID in the SID map will not respond to any requests that come through the MGate MB3000.

## How ID Table is Defined

In the ID table, you specify a range of virtual IDs to be routed to an IP address or serial port. If the virtual ID is different from the actual ID, you will also specify the offset value that will be used to obtain the actual ID.

SID Map Settings		
Setting	Value	Notes
Virtual Slaves ID Range	(numeric range from 1 to 254)	This specifies the range of IDs that will be routed to the selected set of slave devices. For example, you can specify that IDs between 8 and 24 be routed to the devices on Port 3. The ID 255 is reserved for the gateway it's self
Slave ID Offset	(number between -253 and 253)	This specifies the difference between the virtual slave ID and the actual slave ID. For example, if you want the virtual ID to be 16 but the slave's actual ID is 5, you would set the offset to -10.
Slaves Channel IP	0.0.0.0 (or other 32-bit number)	If a Modbus RTU or ASCII master is connected, this specifies the IP address of a Modbus TCP slave.

### ID Table Example

Suppose you were using the four-port MGate MB3480 to integrate two Modbus networks. You want to connect two Modbus ASCII masters to Ports 2 and 4, which will need access to three Modbus TCP slaves. You will also connect several Modbus ASCII slaves to Ports 1 and 3. Since the Modbus ASCII slaves have fixed IDs that cannot be changed, you want the MGate to re-map the IDs as follows:

Actual Slave ID	Virtual Slave ID	Protocol	Location
2	10	ASCII	MGate Port 1
3	11	ASCII	MGate Port 1
4	12	ASCII	MGate Port 1
4	20	ASCII	MGate Port 3
5	21	ASCII	MGate Port 3
6	22	ASCII	MGate Port 3
2	2	TCP	192.168.3.125
7	7	TCP	192.168.3.125
1	1	TCP	192.168.3.111



You will need to modify the virtual ID range for each port on the MGate. Since there are no slaves on Port 2 or 4, their ranges can be set to anything that does not conflict with other ranges. The following settings would achieve the desired result:

Connection	Virtual Slave ID Range	Slave ID Offset
Port 1	10 to 19	-8
Port 2	246 to 246	0
Port 3	20 to 22	-12
Port 4	247 to 247	0

You will also need to add the IP addresses of the TCP slaves to the ID table. The following settings would achieve the desired result:

IP Address	Virtual Slave ID Range	Slave ID Offset
192.168.3.125	2 to 7	0
192.168.3.111	1	0

After you set up the ID table as shown, any requests to IDs between 10 and 19 will be routed to Port 1 on the MGate, and requests to IDs between 20 and 22 will be routed to Port 3. The ASCII masters at Ports 2 and 4 will be able to use IDs 1 to 7 to send requests to the TCP slaves at 192.168.3.125 and 192.168.3.111.

## Customize Modbus Settings

The **Modbus** tab is where certain adjustments can be made to fine tune the communication between different Modbus networks. You can configure **Initial Delay**, **Modbus TCP Exception**, **Slave Channel**, and **Response Time-out**.

Modbus Settings	
Parameter	Value
Initial Delay	Numeric
Modbus TCP Exception	Enable or Disable
Slave Channel	Radio button
Response Time-out	Numeric

### Initial Delay

Some Modbus slaves may take more time to boot up than other devices. For certain environments, this may cause the entire system to suffer from repeated exceptions during the initial boot-up. You can force the MGate to wait after booting up before sending the first request with the "Initial Delay" setting.

## Modbus TCP Exception

The MGate MB3000 is a protocol gateway that transparently passes requests and responses between the Ethernet and serial interfaces. In some situations, it may be necessary for the gateway to return an exception in response to a request from a Modbus TCP master. This is enabled or disabled with the “Modbus TCP Exception” setting. When enabled, the unit can return two types of exception:

Exception	Conditions
Timeout	There is no response from the slave. Maybe the device is off-line or the serial cable is broken.
Request dropped	There are two situations that will result in this exception: <ul style="list-style-type: none"><li>• The request queue is full (32 request queue for each master)</li><li>• The destination ID not included in the SID map.</li></ul>

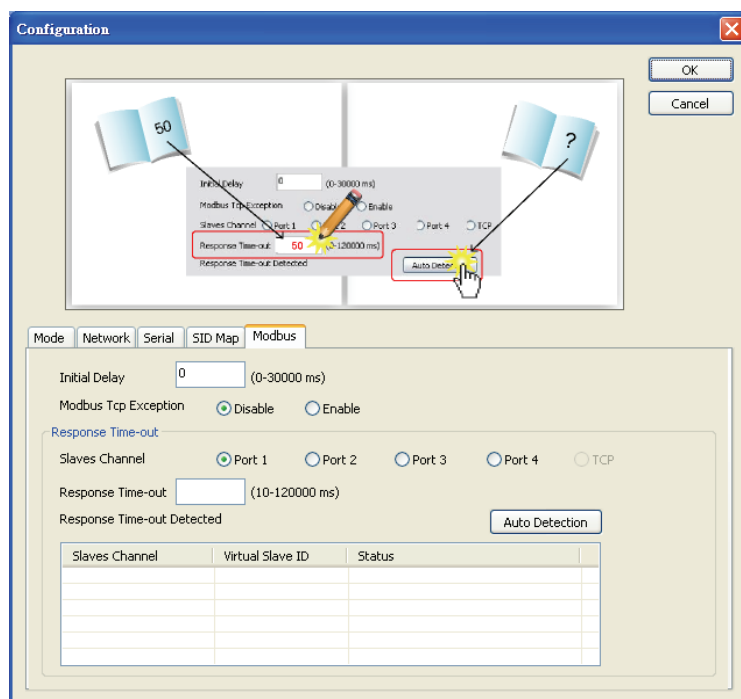
Not all Modbus TCP masters require this exception, so it is up to you to determine if this setting should be enabled.

## Slave Channel and Response Timeout

According to the Modbus standard, the time that it takes for a slave device to respond to a request is defined by the device manufacturer (please refer to Appendix A for details). Based on this response time, a master can be configured to wait a certain amount of time for a slave's response. If no response is received within the specified time, the master will disregard the request and continue operation. This allows the Modbus system to continue operation even if a slave device is disconnected or faulty.

On the MGate MB3000, the “Response Time-out” field is used to configure how long the gateway will wait for a response from a Modbus ASCII or RTU slave. This field is set independently for each serial port, which is selected through the “Slave Channel” field. Please refer to your device manufacturer's documentation to manually set the response time-out.

The MGate MB3000 also provides automatic calibration of the response timeout. Instead of manually figuring out the appropriate setting, you can click “Auto Detection” to have the MGate figure out the setting for you. Once a value has been recommended, you can fine-tune it for best performance.



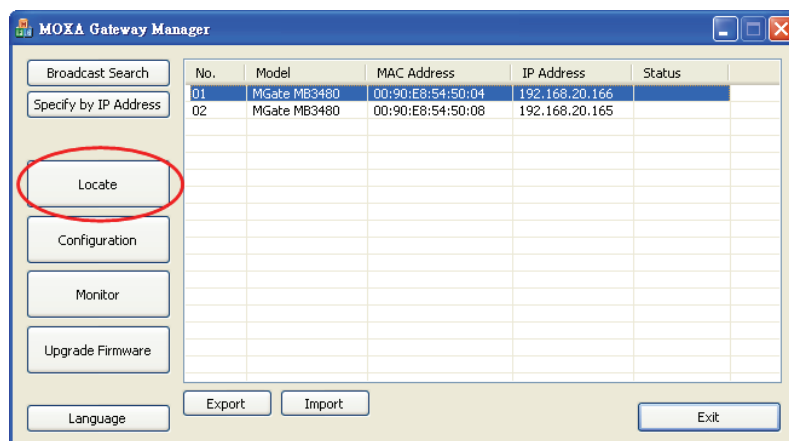
### ATTENTION

Please note the following regarding automatic calibration of response timeouts:

- When automatically detecting the response timeout, the MGate will use the ID table in the **SID Map** tab to determine which ports and which IDs to search. Make sure that you have defined the ID table for your system before clicking “Auto Detection”.
- The automatic calibration will take some time to complete. We recommend that you save this step for last and take a break as the MGate does its work.

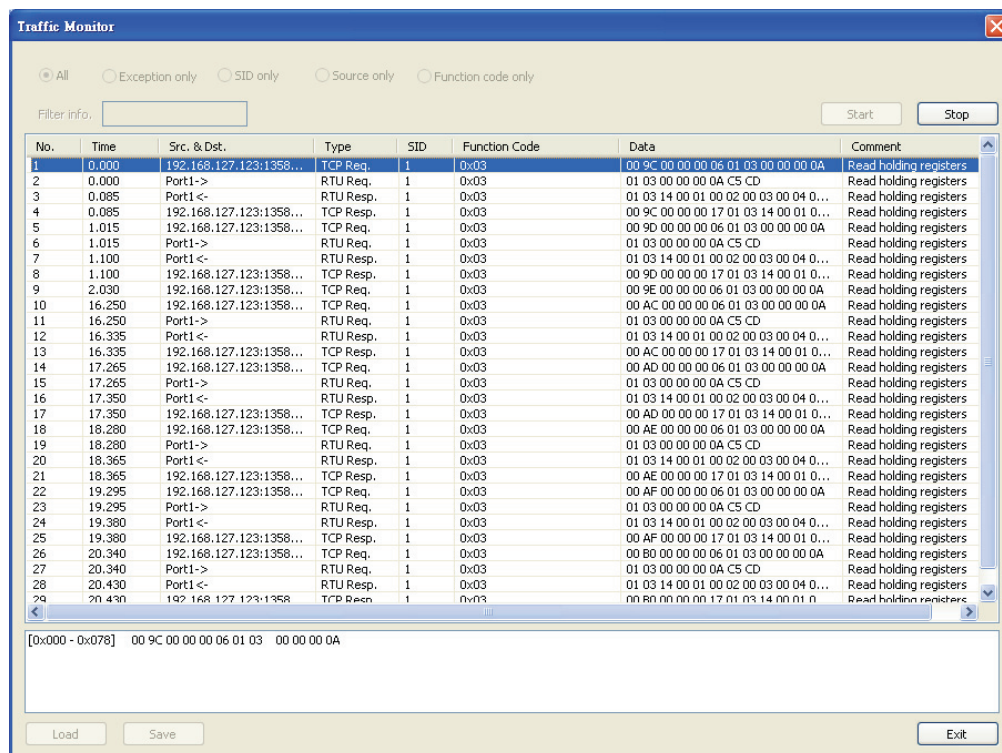
## Verifying Location of Unit

If you are managing multiple MGate units, you may wonder if you are configuring the correct unit in MGate Manager. You can select a unit in MGate Manager and click **Locate** to make that unit's “Ready” LED blink for a few seconds. This will tell you which physical unit corresponds with the unit that you selected.



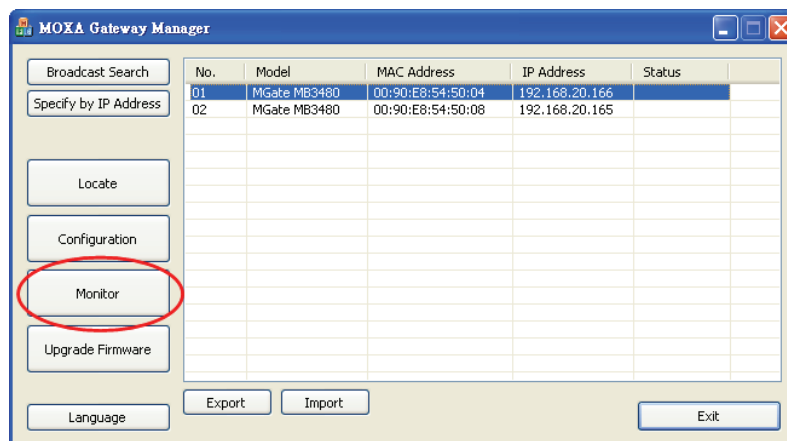
## Monitoring Modbus Activity

For troubleshooting or management purposes, you can monitor the data passing through any MGate MB3000 on the network. Data events will be logged as they pass through the gateway. Rather than simply echoing the data, MGate Manager presents the data in an intelligent, easily-understood format, with clearly designated fields including source, type, destination, contents, and more. Events can be filtered in different ways, and the complete log can be saved to a file for later analysis.

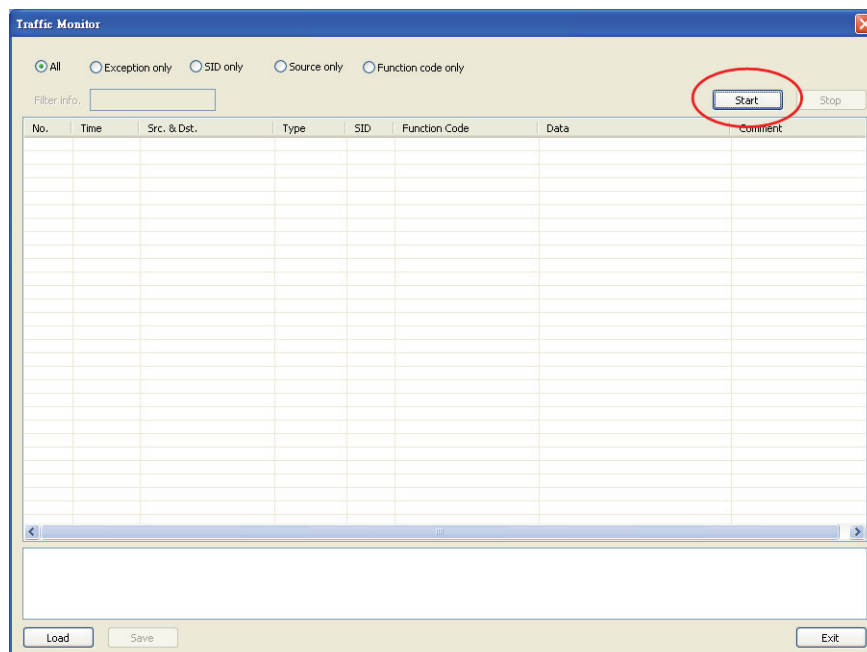


### Open Traffic Monitor Window

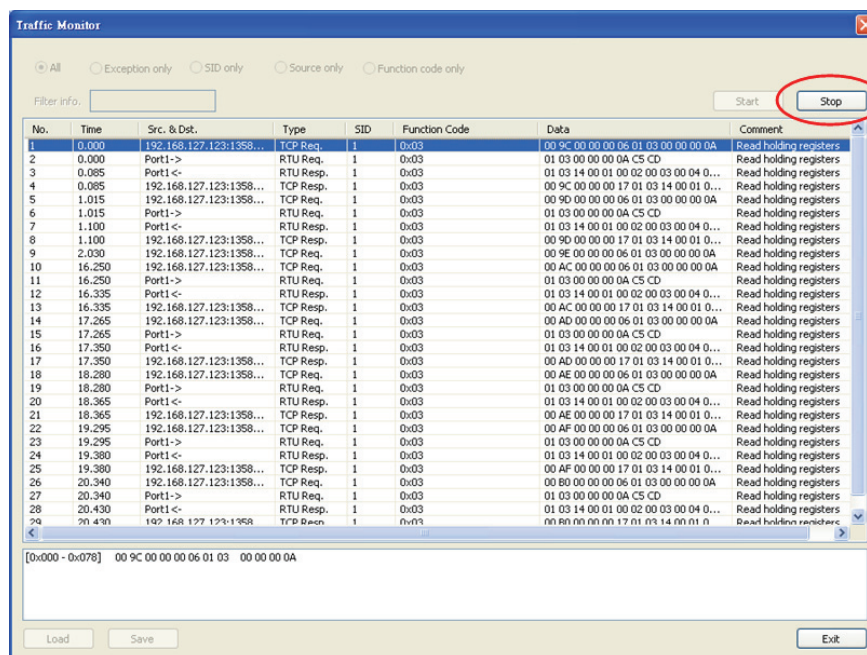
Select the unit that you wish to monitor and click **Monitor** to open the Traffic Monitor window.



In the Traffic Monitor window, click **Start** to begin live monitoring of the data passing through the selected MGate MB3000 unit.



To stop capturing the log, press the **Stop** button.



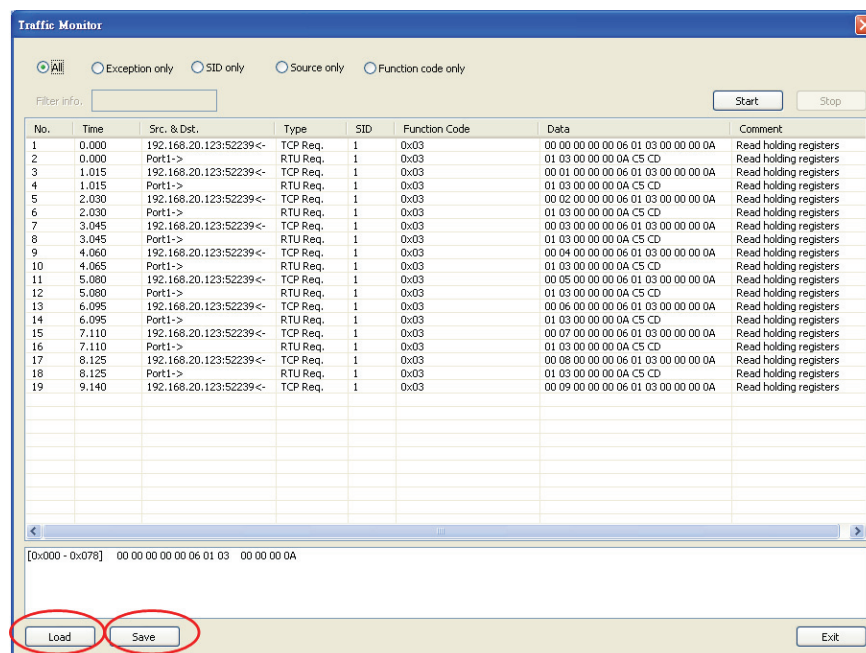
## Filter Traffic Information

By default, all events are displayed in the traffic monitor window. MGate Manager also allows the data to be filtered so only the relevant information is displayed. The filter is selected using the radio buttons and customized using the “Filter info” field, as follows:

Filter	Customization	Description
All	-	Show all traffic
Exception only	-	Show only exceptions
SID only	VSID=<virtual slave ID> (e.g., “VSID=1”)	Show only traffic to and from the specified “virtual” slave ID (as assigned in the MGate’s ID table)
	RSID=<actual slave ID> (e.g., “RSID=1”)	Show only traffic to and from the specified “actual” slave ID (as assigned on the device itself)
Source only	IP=<IP address> (e.g., “IP=192.168.1.2”)	Show only traffic sent from the specified IP address
	PORT=<MGate serial port number> (e.g., “PORT=1”)	Show only traffic sent from the specific serial port on the MGate
Function code only	FCODE=<Modbus function code> (e.g., “FCODE=3”)	Show only traffic for a specific function code

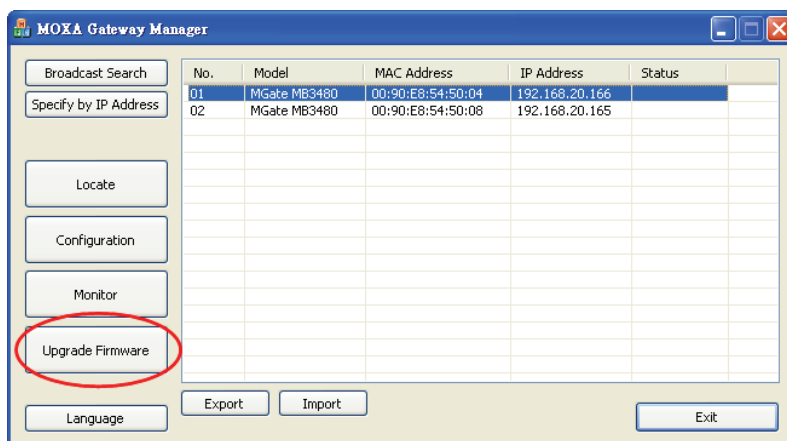
## Save Log to File

To save the data log to a file, click **Save**. You may retrieve a saved log by clicking **Load**.

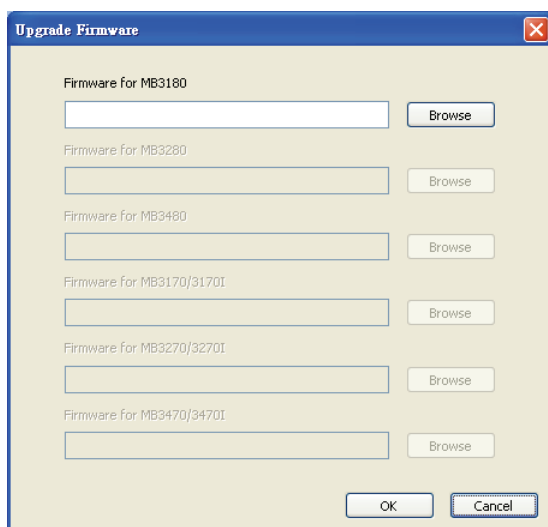


## Upgrading Firmware

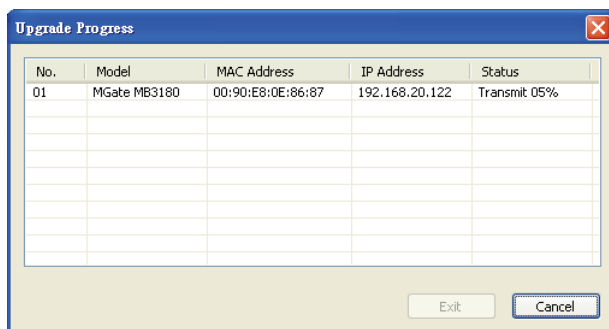
Firmware updates for the MGate MB3000 are located at [www.moxa.com](http://www.moxa.com). After you have downloaded the new firmware onto your PC, you can use MGate Manager to write it onto your MGate MB3000. Select the desired unit from the list in MGate Manager and click **Upgrade Firmware** to begin the process.



The dialog boxes will guide you through the process. You will need to browse your PC for the firmware file. Make sure that it matches your model.



As the firmware is written to the unit, progress is displayed in the window.



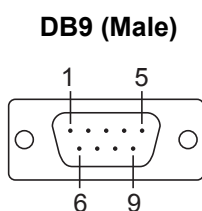
Once the firmware has been successfully written onto the unit, click **Exit** to close the Upgrade Firmware window. MGate Manager will automatically execute a **Broadcast Search** for all MGate MB3000 units on the LAN. Your MGate should reappear in the list of units.



## Pin Assignments

---

The MGate MB3000 uses DB9 (male) serial ports to connect Modbus RTU or ASCII devices. Each port supports three serial interfaces: RS-232, RS-422, and RS-485 (both 2 and 4-wire).



Pin	RS-232	RS-422 and RS-485 (4-wire)	RS-485 (2-wire)
1	DCD	TxD-(A)	---
2	RxD	TxD+(B)	---
3	TxD	RxD+(B)	Data+(B)
4	DTR	RxD-(A)	Data-(A)
5	GND	GND	GND
6	DSR	---	---
7	RTS	---	---
8	CTS	---	---

# 6

## Case Studies

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We discuss the following topics in this chapter:

- ☐ **Introduction**
- ☐ **Replace Serial Masters with Ethernet Master(s), Slave IDs are Configurable**
- ☐ **Replace Serial Masters with Ethernet Master(s), Slave IDs are Fixed**
- ☐ **Keep Serial Master and Add Ethernet Master(s)**
- ☐ **Integrate Modbus RTU, ASCII, and TCP at the Same Time**

## Introduction

There are many reasons a Modbus gateway might be used to integrate Modbus networks. However, every situation has its own requirements and difficulties. Users may wonder how the gateway can help or even if the gateway is suitable for the system.

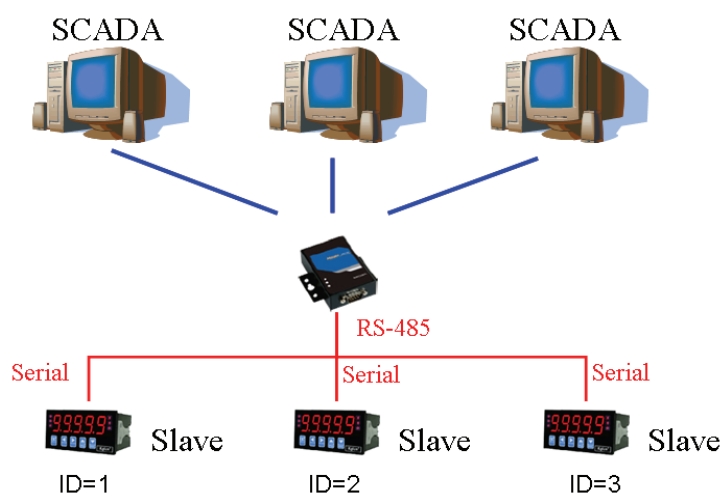
This chapter presents some case studies to help guide. If you can not find the case the same as yours, it does not mean the MGate MB3000 is not suitable with you. Please contact MOXA and we will work it out with you.

## Replace Serial Masters with Ethernet Master(s), Slave IDs are Configurable

In this scenario, the original control system consists of several serial-based systems. In each system, a serial master directly controls serial slave devices, as follows:

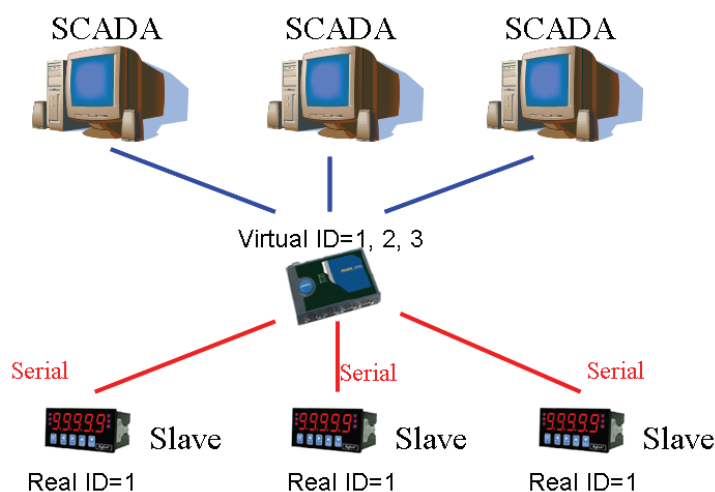


The MGate MB3000 can connect to each serial slave so Ethernet SCADA masters will be able to control them. However, since slave IDs cannot be repeated in a system, we will need to change the IDs of some of the slaves in order to integrate them into a single network, as follows:



## Replace Serial Masters with Ethernet Master(s), Slave IDs are Fixed

Some legacy Modbus slave devices have fixed IDs that cannot be changed. In order to integrate the devices into a Modbus TCP network, the multiport MGate MB3280 or MB3480 can be used to assign virtual slave IDs. For more information about virtual slave IDs, please refer to Chapter 4.

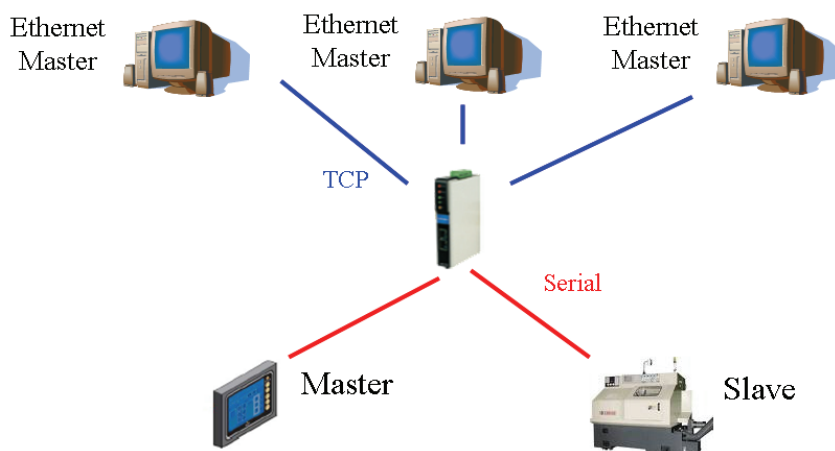


## Keep Serial Master and Add Ethernet Master(s)

In this scenario, the serial control system is a direct, low-latency system. The serial master must not be replaced, but Ethernet masters will need to have access to the serial slaves for monitoring or supervision.



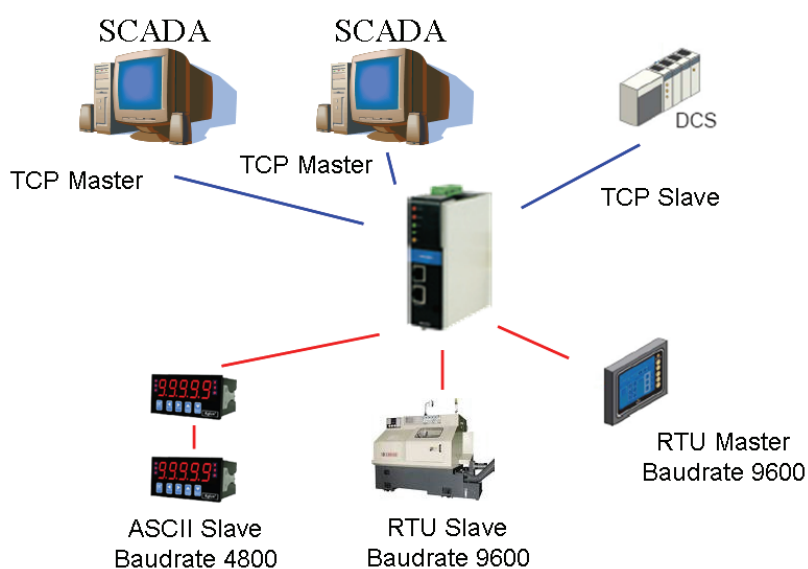
The advanced, multiport MGate MB3270 or MB3470 can be inserted into the serial system, with the slaves connected to one serial port and the master to another serial port. The advanced gateway allows Ethernet masters to communicate with the serial slaves, and it also provides a serial redirector function that simultaneously allows the serial master to continue controlling the slaves.



## Integrate Modbus RTU, ASCII, and TCP at the Same Time

There can be a wide range in number, type, and sophistication of devices on the factory floor. The most common devices are simple serial-based meters, which report certain information relating to factory environment or equipment. However, other Modbus serial slaves may be as complex as a manufacturing machine or a PLC controller.

When integrating these devices, there may be issues if different serial environments are used for different devices. One system may use a different baudrate than another, or may use Modbus ASCII instead of Modbus RTU. The MGate MB3000 allows the different Modbus systems to be integrated into one network, regardless of the protocol or communication parameters.



# Modbus Overview

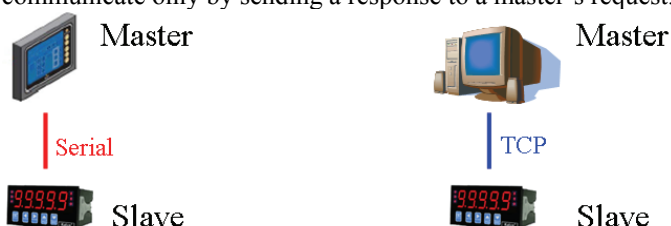
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## Introduction

Modbus is one of the most popular automation protocols in the world. It supports both serial and Ethernet devices. Many industrial devices, such as PLCs, DCSs, HMIs, instruments, meters, motors, and drivers, use Modbus as their communication standard.

## Devices are Either Masters or Slaves

All Modbus devices are classified as either a master or a slave. Masters initiate all communication with slaves and do not communicate to other masters. Slaves are completely passive and communicate only by sending a response to a master's request.



## Slaves are Identified by ID

Each Modbus slave in a system is assigned a unique ID between 1 and 247. Whenever a master makes a request, the request must include the ID of the intended recipient. Master devices themselves have no ID.

0	1~247	248~255
Broadcast address	Slave individual address	Reserved

## Communication is by Request and Response

All Modbus communication is by request and response. A master sends a request and a slave sends a response. The master will wait for the slave's response before sending the next request. For broadcast commands, no response is expected. This is illustrated by three scenarios as follows:

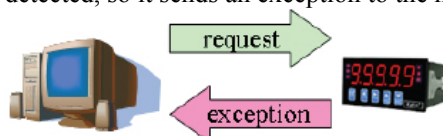
### Normal

The master sends a request to the slave. The slave sends a response with the requested information.



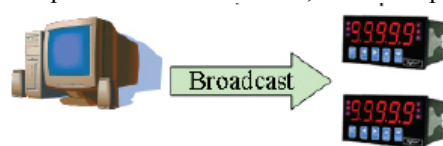
### Exception

The master sends a request to the slave. The slave may not support the command or an error is detected, so it sends an exception to the master.



### Broadcast

The master sends a broadcast command, such as a reset command. Every slave on the network complies with the command, and no response is sent to the master.

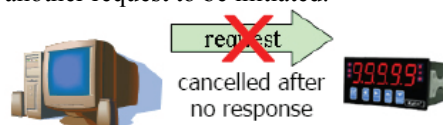


## Requests Need a Time Limit

The original Modbus protocol was not designed for simultaneous requests or simultaneous masters, so only one request on the network can be handled at a time. When a master sends a request to a slave, no other communication may be initiated until after the slave responds. The Modbus protocol specifies that masters use a response timeout function to identify when a slave is nonresponsive due to device or line failure. This function allows a master to give up on a request if no response is received within a certain amount of time. This is illustrated as follows:

### Response Timeout

The master sends a request. The slave is unresponsive for the amount of time specified by the response timeout function. The master gives up on the request and resumes operation, allowing another request to be initiated.



To allow for a wide range of devices, baudrates, and line conditions, actual response timeout values are left open for manufacturers to determine. This allows the Modbus protocol to accommodate a wide range of devices and systems. However, this also makes it difficult for system integrators to know what response timeout value to use during configuration, especially with older or proprietary devices.

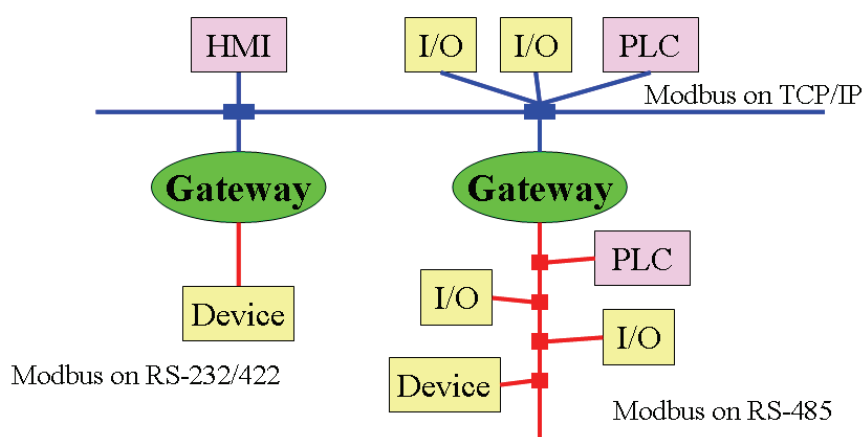
The MGate MB3000 provides a patent-pending function that tests all attached devices and recommends a response timeout value. This function saves considerable time and effort for system integrators, and results in more accurate timeout settings.

## Modbus Ethernet vs. Modbus Serial

Although Modbus standard is intended as an application layer messaging protocol, the data format and communication rules for Ethernet-based Modbus TCP are different from serial-based Modbus ASCII and RTU.

The major difference between the Ethernet and serial Modbus protocols is the behavior of the communication model. Modbus ASCII and RTU allow only one request on the network at a time. Once a request is sent, no other communication on the bus is allowed until the slave sends a response, or until the request times out. However, Modbus TCP allows simultaneous requests on the network, from multiple masters to multiple slaves. TCP masters cannot send more than one request at a time to a slave, but they can send requests to other slaves before a response is received. The Modbus TCP standard recommends that slaves be able to queue up to 16 requests at a time. The MGate MB3000 will queue up to 32 requests from each TCP master, for up to 16 TCP masters.

## Integrate Modbus Serial and Ethernet with Gateways



Ordinarily, Modbus TCP and Modbus ASCII/RTU are unable to communicate with each other. However, with a Modbus gateway in between the Modbus serial network and the Modbus Ethernet network, TCP masters are able to communicate to serial slaves and serial masters are able to communicate to TCP slaves.





# Declaration of Conformity

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Manufacturer's Name: Moxa Technologies Co., Ltd.  
Manufacturer's Address: Fl.4, No.135, Lane 235, Pao-Chiao Rd., Shing Tien  
City, Taipei, Taiwan, R.O.C.

**Declares that the product:**

Product Name: MGate MB3000 series  
Model Number: MGate MB3180, MGate MB3480

**Conforms to the following standards:**

EMC: FCC Class B  
EN55022:1998 class B  
EN61000-3-2:1995 class B  
EN61000-3-3:1995  
EN55082-1:1997  
EN61000-4-2:1995  
Contact Discharge 4kV, Air Discharge 8kV  
EN61000-4-3:1995  
EN61000-4-4:1995  
AC/DC Power supply 1kV, Data/Signal lines 5kV  
EN61000-4-5:1995  
AC/DC Line to Line 1kV, AC/DC Line to Earth 2kV  
EN61000-4-6:1995  
EN61000-4-8:1993  
3A/m at 50Hz  
EN61000-4-11:1994  
Safety: UL/CUL, TUV  
EN60950

# C

## Service Information

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This appendix shows you how to contact Moxa for information about this and other products, and how to report problems.

In this appendix, we cover the following topics:

- ☐ **MOXA Internet Services**
- ☐ **Problem Report Form**
- ☐ **Product Return Procedure**

## MOXA Internet Services

Customer satisfaction is our number one concern, and to ensure that customers receive the full benefit of our products, MOXA Internet Services has been set up to provide technical support, driver updates, product information, and user's manual updates.

The following services are provided:

### **E-mail for Technical Support**

[support@moxa.com](mailto:support@moxa.com)

### **Website for Product Information**

<http://www.moxa.com>

## MGate MB3000

This image shows a full page of blank white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page, providing a template for writing or drawing. There are no margins, text, or other markings on the paper.

## Product Return Procedure

For product repair, exchange, or refund, please follow these instructions:

- Provide evidence of original purchase.
- Obtain a Product Return Agreement (PRA) from the sales representative or dealer.
- Fill out the Problem Report Form (PRF). Include as much detail as possible for a shorter product repair time.
- Carefully pack the product in an anti-static package, and send it, pre-paid, to the dealer. The PRA should be visible on the outside of the package, and include a description of the problem, along with the return address and telephone number of a technical contact.